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Screening and decolonization of MRSA among joint arthroplasty patients: efficacy, cost-effectiveness and durability

E. Carlos Rodriguez-Merchan

Department of Orthopedic Surgery, La Paz University Hospital, Paseo de la Castellana 261, 28046, Madrid, Spain

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ABSTRACT

Objective: To review the literature with the aim of answering the following three questions: 1) Is screening and decolonization effective in reducing the rate of infection after elective joint arthroplasty? 2) Is screening and decolonization cost-effective? 3) What is the durability of decolonization?

Methods: The search engines were MedLine (PubMed), Google Scholar and the Cochrane Library. The keywords used were: preoperative MRSA screening. Seven thousand nine hundred and forty eight articles were found until 30 September 2014 (seven thousand eight hundred and fifty in Google Scholar, ninety-seven in MedLine and one in the Cochrane Library). Of those, only eighteen were selected and reviewed because they were strictly focused on the question of this article.

Results: The types of studies reported have a low level of evidence. Most of them are prospective case series, although some of them are systematic reviews of level III studies. There is a tendency toward fewer MRSA infections after elective joint arthroplasty. Decolonization has shown to be strongly cost-effective with 33% of postoperative arthroplasty patients tests positive for *Staphylococcus aureus* colonization at 3 to 30 months after surgery.

Conclusions: There is a tendency toward fewer MRSA infections after total joint arthroplasty when screening and decolonization is used. Decolonization is strongly cost-effective procedure with 33% of patients tests positive for MRSA 3 to 30 months after surgery. Larger, randomized, controlled studies are needed to confirm the apparent efficacy of decolonization.

1. Introduction

Staphylococcus aureus (*S. aureus*) is the most common organism responsible for orthopaedic surgical site infections (SSIs) after elective joint arthroplasty. Patients who are carriers for methicillin resistant *S. aureus* (MRSA) have a higher likelihood of having invasive MRSA infections[1].

Some reports have suggested that screening and decolonization of all patients having elective joint arthroplasty will decrease the incidence of postoperative infections[2]. They believe that a prescreening program (nasal swab using polymerase chain reaction-based testing), followed by an appropriate eradication using a 5- to 14-d course of nasal mucopirocin (2% nasal ointment) will lower the rate of SSIs[3].

Although some have advocated screening and decolonization[3,4], it is unclear whether these efforts reduce SSIs[1]. In other words, while some institutions and surgeons have implemented universal screening and decolonization on their patients undergoing elective arthroplasty, others remain unconvinced about the efficacy of this process[5].

The purpose of this article is to revise the literature with the aim of answering the following three questions: 1) Is screening and decolonization of MRSA effective in reducing the incidence of postoperative infection after elective joint arthroplasty? 2) Is decolonization cost-effective? 3) What is the durability of decolonization?

*Corresponding author: Prof. E. Carlos Rodriguez-Merchan, Department of Orthopedic Surgery, La Paz University Hospital, Paseo de la Castellana 261, 28046-Madrid, Spain.
E-mail: ecrmerchan@gmx.es

2. Materials and methods

A review has been performed on the role of screening and decolonization of MRSA in reducing the incidence of postoperative infection after elective joint arthroplasty. The keywords used were: preoperative MRSA screening. The search engines were MedLine (PubMed), Google Scholar and the Cochrane Library. Seven thousand eight hundred and forty eight articles were found until 30 September 2014 (seven thousand eight hundred and fifty in Google Scholar, ninety-seven in MedLine and one in the Cochrane Library). Of those, only eighteen were selected and reviewed because they were strictly focused on the question of this article.

3. Results

The types of studies reported have a low level of evidence (level III, level IV). Most of them are prospective case series (level IV), although some of them are systematic reviews of level III studies. A survey reported by Diekema *et al.* showed that only 60% of physicians reported preoperative screening for *S. aureus*[6]. The incidence of nasal carries of MRSA reported in the orthopaedic literature is very variable, ranging from 1.10% to 25.00% (Table 1)[3,7-14].

Table 1
Incidence of nasal carriers of MRSA and reduction of the rate of SSI in elective joint arthroplasty.

Incidence of nasal carries of MRSA (%)	Reduction of the rate of SSI	Reference
6.00	NA	[7]
0.23	From 0.30% to 0%	[8]
1.10	NA	[9]
1.45	From 1.45% to 1.28%	[10]
4.40	From 0.97% to 0.14%	[11]
6.60	NA	[12]
0.49	From 0.49% to 0.24%	[13]
18.00-25.00	NA	[3]
4.60	From 4.6% to 0%	[14]

NA: Nonavailable.

Regarding the efficacy of decolonization, the orthopaedic literature has shown a tendency toward fewer MRSA infections after total joint arthroplasty (Table 1). In the study of Mehta *et al.* before implementation of screening and decolonization there was a prevalence density rate (MRSA-positive cultures) of 1.23 per 1000 patient-days. After screening and decolonization, the rate was 0.83 per 1000 patient-days[15].

Two reports have shown that preoperative screening and decolonization of MRSA is strongly cost-effective (incremental cost-effectiveness ratio less than $6 000 per quality-adjusted life year) from the third-party payer perspective even when MRSA prevalence was as low as 1%, decolonization success was as low as 25%, and decolonization costs were as high as $300 per patient[16]. In most scenarios this strategy was economically dominant (*i.e.*, less costly and more effective than no screening). Routine preoperative screening and decolonization of patients undergoing elective joint arthroplasty may under many circumstances save hospitals and third-party payers money while providing health benefits. Slover *et al.* conducted a Markov decision analysis to assess the cost savings associated with a preoperative MRSA screening and decolonization program on hip and knee arthroplasties[17]. They concluded that universal MRSA screening and decolonization for hip and knee arthroplasty patients needs to result in only a modest reduction in the SSI rate to be cost saving.

Concerning the durability of decolonization, arthroplasty surgeons must be aware that a decolonization treatment does not guarantee that a patient will remain decolonized in the future[18]. In a study, 33% of postoperative arthroplasty patients tested positive for MRSA colonization at 3 to 30 months after surgery despite preoperative decolonization[18].

4. Discussion

The purpose of this article was to review the literature after 2008 with the aim of answering the following the following three questions: 1) Is screening and decolonization of MRSA effective in reducing the rate of postoperative infection after elective joint arthroplasty? 2) Is decolonization cost-effective? 3) What is the durability of decolonization?

The quality of studies reported so far on the topic is poor (low level of evidence, level III, level IV). Most of them are prospective case series (level IV), although some are systematic reviews of level III studies[1-18].

In a survey only 60% of physicians reported preoperative screening for *S. aureus*[6]. The incidence of nasal carries of MRSA in the orthopaedic literature is very variable, ranging from 1.10% to 25.00%[4,7-14].

Regarding the efficacy of decolonization, a reduction of the incidence of postoperative SSI after elective joint arthroplasty has been found in the literature. The prevalence density rate (MRSA-positive cultures) of 1.23 per 1000 patient-days before decolonization dropped to 0.83 per 1000 patient-days after decolonization[14].

Preoperative MRSA screening and decolonization is strongly cost-effective (incremental cost-effectiveness ratio less than $6 000 per quality-adjusted life year) from the third-party payer perspective even when MRSA prevalence was as low as 1%, decolonization success was as low as 25%, and decolonization costs were as high as $300 per patient[16].

A Markov decision analysis showed that universal *S. aureus* screening and decolonization for hip and knee arthroplasty patients needs to result in only a modest reduction in the SSI rate to be cost saving.

Concerning the durability of decolonization, arthroplasty surgeons must be aware that a decolonization treatment does not guarantee that a patient will remain decolonized in the future[18]. In a study, 33% of postoperative arthroplasty patients tested positive for MRSA colonization at 3 to 30 months after surgery despite preoperative decolonization[18].

In conclusion, the review of the literature found a tendency toward fewer MRSA SSIs after total joint arthroplasty when a screening and decolonization program was used. However, most of these studies were underpowered. Larger, randomized, controlled studies are needed to confirm the apparent efficacy of decolonization. Screening and decolonization is a cost-effective procedure. Regarding the durability of decolonization, one third of patients tested are positive for *S. aureus* at 3 to 30 months after surgery.

Conflict of interest statement

The author declare that there are no conflicts of interest.

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